

PURCHASE DESCRIPTION
PROPELLANT, RP-1

1. SCOPE.

1.1 Scope. This purchase description covers four grades of propellant for use in rocket engines.

1.2. Classification. RP-1 propellant will be of the following designated grades:

Grades

- Standard – Normal production, suitable for most uses
- TS-30 – Lower total sulfur content than standard grade (max 30 mg/kg)
- TS-5 – Strict control of sulfur and other properties, used to decrease coking in the cooling chambers of the rocket engine
- Ultra-Low – Same as TS-5 but with less than 100ppb total sulfur

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in Sections 3 and 4 of this purchase description. This section does not include documents in other sections of this purchase description or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this purchase description, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following standard forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of this document is that listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-STD-290 – Packaging and Marking of Petroleum and Related Products

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation.

Beneficial comments (recommendations, additions, deletions) and any data which may be of use in improving this document should be sent to:

DESC-BP
Building 1621-K
2261 Hughes Ave, Ste 128
Lackland AFB TX 78236-9828

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 86 - Standard Test Method for Distillation of Petroleum Products
- ASTM D 93 - Standard Test Method for Flash Point by Pensky-Martens Closed Tester
- ASTM D 130 - Standard Test Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test
- ASTM D 240 - Standard Test Method Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter
- ASTM D 381 - Standard Test Method for Gum Content in Fuels by Jet Evaporation
- ASTM D 445 - Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids
- ASTM D 611 - Standard Test Methods for Aniline Point and Mixed Aniline Point of Petroleum Products and Hydrocarbon Solvents
- ASTM D 873 - Standard Test Method for Oxidation Stability of Aviation Fuels (Potential Residue Method)
- ASTM D 1094 - Standard Test Method for Water Reaction of Aviation Fuels
- ASTM D 1298 - Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- ASTM D 1319 - Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
- ASTM D 1322 - Standard Test Method for Smoke Point of Kerosine and Aviation Turbine Fuel
- ASTM D 2386 - Standard Test Method for Freezing Point of Aviation Fuels
- ASTM D 2622 - Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-Ray Fluorescence Spectrometry
- ASTM D 3227 - Standard Test Method for (Thiol Mercaptan) Sulfur in Gasoline, Kerosine, Aviation Turbine, and Distillate Fuels (Potentiometric Method)
- ASTM D 4052 - Standard Test Method for Density and Relative Density of Liquids by Digital Density Meter
- ASTM D 4057 - Standard Practice for Manual Sampling of Petroleum and Petroleum Products
- ASTM D 4177 - Standard Practice for Automatic Sampling of Petroleum and Petroleum Products
- ASTM D 5452 - Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration
- ASTM D 5453 - Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Motor Fuels and Oils by Ultraviolet Fluorescence
- ASTM D 5623 - Standard Test Method for Sulfur Compounds in Light Petroleum Liquids by Gas Chromatography and Sulfur Selective Detection
- ASTM E 29 - Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken PA 19428-2959.)

AMERICAN PETROLEUM INSTITUTE

- API 1581 - Specifications and Qualification Procedures for Aviation Jet Fuel Filter/Separators

(Application for copies should be addressed to the Portland Customer Services, Commerce Way, Whitehall Industrial Estate, Colchester CO2 8HP, UK or email: sales@portland-services.com)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Material. The propellant shall consist completely of hydrocarbon compounds except as otherwise specified herein.

3.2 Chemical and physical properties. The chemical and physical properties of the propellant shall conform to those listed in Table I when tested in accordance with the applicable test methods.

3.2.1 Water Reaction. When tested as specified in Table I and 4.4.2.1, the propellant shall have separated sharply from the water layer. The interface shall be equal to or better than rating 1b as described in ASTM Test Method D 1094, Table 2. In addition, neither layer shall have changed in volume by more than 1 milliliter.

Table I – Chemical and Physical Properties

Property	Limit				ASTM Test Method
	Standard	TS-30	TS-5	Ultra-Low	
Distillation					D 86
Initial Boiling Point (°F)	\a	\a	\a	\a	
Fuel evaporated, 10% (°F)	365 – 410	365 – 410	365 – 410	365 – 410	
Fuel evaporated, 50% (°F)	\a	\a	\a	\a	
Fuel evaporated, 90% (°F)	\a	\a	\a	\a	
End point (°F)	525 max	525 max	525 max	525 max	
Residue (%vol)	1.5 max	1.5 max	1.5 max	1.5 max	
Distillation loss (%vol)	1.5 max	1.5 max	1.5 max	1.5 max	
Specific Gravity (60/60°F)	.799 - .815	.799 - .815	.799 - .815	.799 - .815	D 1298 ^b
Existent Gum (mg/100mL)	7 max	1 max	1 max	1 max	D 381
Potential Gum, 16 hr aging (mg/100mL)	14 max	5 max	5 max	5 max	D 873
Sulfur, total (mg/kg)	500 max	30 max	5 max	0.1 max	D 5623 ^c
Mercaptan-sulfur (mg/kg)	50 max	10 max	0.1 max	0.1 max	D 3227
Freezing Point (°F)	-36 max	-60 max	-60 max	-60 max	D 2386
Thermal Value: Net heat of combustion (BTU/lb)	18,500 min	18,500 min	18,500 min	18,500 min	D 240
Viscosity (centistokes at -30°F)	16.5 max	16.5 max	16.5 max	16.5 max	D 445
Aromatics (%vol)	5.0 max	5.0 max	5.0 max	5.0 max	D 1319
Olefins (%vol)	2.0 max	1.0 max	0.5 max	0.5 max	D 1319
Smoke point (mm)	25.0 min	25.0 min	25.0 min	25.0 min	D 1322
Copper strip corrosion (ASTM classification)	1 max	1 max	1 max	1 max	D 130 ^d
Water reaction interface (ASTM classification)	\e	\e	\e	\e	D 1094
Flash point (°F)	110 min	140 min	140 min	140 min	D 93
Aniline point (°F)	\a	\a	\a	\a	D 611
Particulate (mg/gal)	5.7 max	1.0 max	1.0 max	1.0 max	D 5452

\a – To be reported only – not limited.

\b – ASTM test method D 4052 may also be used, in the event of dispute, method D 1298 shall be the referee method.

\c – for other than the ultra-low grade, ASTM test method D 5453 may also be used, in the event of dispute, method D 5623 shall be the referee method

\d – procedure shall be carried out in accordance with paragraph 9.1.4 of ASTM D 130-94.

\e – See 3.2.1 for requirements and 4.4.2.1 for exception to ASTM D 1094.

3.3 Additives. The additives listed herein may be used singly or in combination, in amounts not to exceed those specified. No substance of known dangerous toxicity under usual conditions of handling and use shall be added except as specified herein. The type and amount of each additive used shall be reported.

3.3.1 Antioxidants. The following active inhibitors may be added separately or in combination to the propellant in total concentration not in excess of 8.4 pounds of inhibitor (not including weight of solvent) per 1,000 barrels (6.2.1) of fuel (9.1 gm/100 US gal) in order to prevent the formation of gum.

- (a) 2,6-ditertiary butyl 4-methyl phenol.
- (b) N,N' disecndary butyl paraphylenediamine.
- (c) 2,4-dimethyl-6 tertiary-butyl phenol.
- (d) 2,6-detertiary butyl phenol

3.3.2 Metal deactivator. A metal deactivator, N,N'-disalicylidene-1,2-propanediamine, may be added in an amount not to exceed 2 pounds of active ingredient per 1,000 barrels of fuel (2.2 gm/100 US gal).

3.3.3 Dye. A dye, methyl derivative of azobenzene-4-azo-2-naphthol, may be added in an amount not to exceed ½ ounce (wt) per 100 U.S. gallons of fuel.

3.4 Limiting values. For purposes of determining conformance with these requirements, an observed value or a calculated value shall be rounded off "to the nearest unit" in the last right-hand digit used in expressing the specified limit according to the rounding-off method of ASTM Practice E 29 for Using Significant Digits in Test Data to Determine Conformance with Specifications.

3.5 Filter. A filter/separator (F/S) conforming to the requirements of API 1581 shall be installed on the fill line upstream of the header used for filling the delivery containers.

3.6 Workmanship. At the time of Government acceptance, the finished fuel shall be visually free from un-dissolved water, sediment, or suspended matter and shall be clear and bright (no haze or cloudiness). In case of dispute, the fuel shall be clear and bright at 70°F.

4. VERIFICATION

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in this purchase description where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests. The inspection and testing of the propellant requirements specified herein are classified as quality conformance tests. (see 4.3)

4.3 Quality conformance tests. Quality conformance tests shall consist of the following:

- a. Individual Test..... 4.3.1
- b. Sampling Test 4.3.2

4.3.1 Individual Test. The propellant shall be subject to the following test as described under 4.4.

Examination of product 4.4.1

4.3.2 Sampling Test. The propellant shall be sampled according to 4.3.2.1 and the samples tested for conformance to the limits of Table I utilizing the procedures described under 4.4.

4.3.2.1 Sampling plan.

4.3.2.1.1 Lot. A lot shall consist of one of the following:

a. The propellant produced in not more than 24 consecutive hours from a continuous process which is used to fill shipping containers directly from the process output. A continuous process shall be the production of product by continuous input of raw materials and output of finished product by one manufacturer in one plant with no change in manufacturing conditions or materials.

b. The propellant from individual runs of a batch process which is used to fill shipping containers directly from the process output. A batch process shall be the production of product by single additions of raw materials which are reacted and purified forming the product.

c. The propellant from either or both the continuous and batch processes which is held in a single storage tank and subsequently withdrawn to fill shipping containers. The product shall be homogenous at the time of withdrawal and shall not be added to while being withdrawn. After each addition to the storage tank, the contents shall constitute a separate lot.

4.3.2.1.2 Sample. A sample shall consist of no less than two U.S. gallons. Sampling shall be in accordance with ASTM Practice D 4057 or ASTM Practice D 4177.

4.4 Test methods.

4.4.1 Examination of Product. The propellant sample shall be visually examined while performing tests specified in table I to determine compliance with the requirement specified in 3.6. Examination shall be conducted after the sample has been transferred to the test apparatus.

4.4.2 Testing. Unless otherwise specified in the contract or purchase order, or elsewhere in this purchase description, tests as specified in 3.2 shall be conducted in accordance with ASTM standards, using applicable methods as listed in table I.

4.4.2.1 Water reaction. The water reaction test shall be conducted in accordance with ASTM test method D 1094, except that a 2-hour rather than a 5-minute standing period shall be used before evaluating the propellant-water interface.

4.5 Rejection and retest. When any sample of the propellant tested in accordance with 4.3 fails to conform to the requirements specified herein, the entire lot represented by the sample shall be rejected. Rejected material shall not be resubmitted without furnishing full particulars concerning previous rejection and measures taken to overcome defects.

5. PACKAGING.

5.1 Packaging. Unless otherwise specified in the contract or purchase order, the packaging and marking requirements shall be in accordance with MIL-STD-290.

6. NOTES.

6.1 Intended use. The propellant covered by this purchase description is intended for use as a fuel in rocket engines and as a hydraulic fluid medium in rocket engine gimbal systems.

6.2 Definitions.

6.2.1 Barrel. A barrel as specified herein will contain 42 U.S gallons.